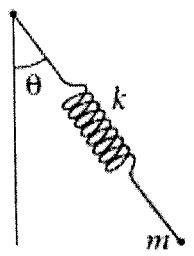
淡江大學 102 學年度日間部轉學生招生考試試題

系別：物理學系三年級　　科目：理 論 力 學

考試日期: 7月24日(星期三) 第3節　　本試題共 4 大題 1 頁

1. [25%]A pendulum consists of a mass m suspended by a massless spring with unextended length b and spring constant k.



   a. [5%]Determine the Lagrangian of the system using plane polar coordinates.
   b. [10%]Determine the Lagrange's equations of motion.
   c. [10%]Determine the Hamilton's equation of motion.
2. [25%] Consider a boat of mass m of horizontal motion in a medium in which the retarding force is proportional to the velocity, say $f_r = -kmv$. If the boat has initial velocity v_0 at t=0, find the displacement and velocity as function of time.
3. [25%] A communications satellite is in a circular orbit around Earth at radius R and velocity v. A rocket accidentally fires quite suddenly, giving the rocket an inward radial velocity v in addition to its original velocity.
   a. [10%] What orbit does the satellite then have?
   b. [15%] What is its closest distance to Earth?
4. [25%] Calculate that the small angular deviation for a plumb line from the true vertical (i.e., toward the center of Earth) at a point on Earth surface at a latitude 45°, given the gravitational field vector $\mathbf{g}_0 = -9.8\left(\text{m/sec}^2\right)\mathbf{e}_R$ and the radius of Earth $R = 6371\text{km}$.